HILLTOPPING AND DEFENCE BEHAVIOUR IN A DIURNAL AGARISTID MOTH

By Noel McFarland
P.O. Box 475, Geraldton, Western Australia, 6530.

Abstract

Hilltopping and territorial behaviour are reported and discussed for adult males of the widespread Australian diurnal moth, *Comocrus behri* (Angas) (Lepidoptera: Agaristidae). Defence behaviour in the adult male is also described.

Introduction

Comocrus behri (Angas) is a widespread and relatively common native Australian agaristid with a wingspan of 60 - 75 mm (Common, 1966); it can be encountered over much of southern Australia during spring, summer and autumn. In the Geraldton district of Western Australia (latitude about 29°) it is also on the wing, in very low numbers, during the winter. In this district, during the past three years, I have several times observed *C. behri* (a strictly diurnal moth) exhibiting the wellknown "hilltopping" behaviour, as reported for many butterfly species in Australia and other countries. To my knowledge, such behaviour has not previously been reported for diurnal moths. Oakley Shields (pers. comm.) has recently verified this impression.

Interpretation of what constitutes "true" hilltopping behaviour is controversial. By no means are all insects encountered flying over hilltops or along ridges necessarily exhibiting hilltopping behaviour; many of these are simply passing from one area to another. Such flights are commonly observed in certain diurnal Australian moths, butterflies and other insects. There are also borderline cases in diurnal moths, in which a definite propensity is shown for flying along ridges and over summits. These species, however, do not tend to linger, or to repeatedly patrol around a selected site, or to establish and defend territories.

My interpretation of the hilltopping in *C. behri* reported below is based upon two key observations:– (1) Definite *territoriality* is shown by males of this moth when observed on hilltops. They vigorously chase away intruders of comparable size, even including small stones thrown experimentally across their field of vision. Some intruders they ignore. (2) These males will *return* immediately and persistently to the same hilltop or ridge, even when repeatedly chased away. An individual will sometimes spend long periods hovering and patrolling around one hilltop, occasionally alighting to rest on a favoured bush or low plant, or directly on the rocky ground. This behaviour even takes place on chilly and very windy mornings, provided the sun is shining. Under such windy conditions the moth is, of course, obliged to fly very strongly and steadily in order to maintain its position over the hilltop. It persistently maintains a strong flight into the wind, and if it is blown far out from its hovering location by a particularly strong wind gust, it "rides" the wind and drops a little, but quickly makes its way back to its former location (or very close thereto) as soon as any weakening in the wind permits.

These two factors, territoriality in the chosen location and persi return to the same hilltop, are essential components of true hilltopping be iour. Short "patrolling" flights over and around the hilltop or along a ridge take place at intervals, but return can usually be anticipated. Patr behaviour is usually (if not always) associated with territorial behaviour.

In *C. behri*, periods of perching are usually of short duration in relati the time spent fluttering over a selected spot and around the hilltop, chasing off intruders and returning. One exception was noted: in cool wea passing clouds that obscure the sun will quickly cause perching an immediate assumption of the normal "roof-like" (tectiform) resting pos with the fore wings totally covering the hind wings. Fluttering and patrolli only resumed after the return of sunshine. It is possible that this typ interruption to hilltopping activity in *C. behri* does not take place during periods if the temperature is above a certain threshold; more observation needed to clarify this point.

Hilltopping observations

LOCALITY 1. Moresby Ranges, Oakajee district, Western Australia km N of Geraldton), at an elevation of about 180 m above sea level. The small and isolated but sharply-defined hill, is the highest in the immed vicinity, and quite unlike any others in the area. It is roughly circular in ou and dome-shaped, with a nearly flat summit about 14 m across. It is mo barren with a covering of brown lateritic pebbles. Although sloping up ste to its summit, it is smoothly continuous with the open grassy fields on its SE NE and N sides, and is deeply eroded on its SW, W and NW sides, formi sharp 4 m cliff along that side, with conspiciously white and barren clay in deeply cut eroded gullies that radiate out to the W and SW. This hill comma a wide and unobstructed view in all directions; it is a conspicuous landmark to the white eroding zone of its western side, which is set off by the gr slopes leading up to it. The areas closely surrounding it have long been clea for sheep grazing, but dense evergreen native shrubby vegetation approa within about 60 m to the west. In all other directions the open grassy paddo isolate the hill much more extensively.

On the top of the hill, at its N-NE side, were growing two small but dense, wind-cropped *Acacia tetragonophylla* F. Muell. (about 3 m apart) crown widths of about 2-3 m and 1.5-2 m in height. Between and below (to the N) were growing two younger individuals of the same *Acacia*, of 1 m dia. and 0.5 m tall. On the SE side of the hilltop was a moribund *Casu campestris* Diels., about 1.6 m high, which has since died. The smaller flora over the dome consisted mostly of a sparse scattering of two small, native grasses and a few native forbs (1973-74). On the E and N slopes of thi was a conspicuously large patch of a pure-white everlasting annual compo blending down into the grassy paddock on that side.

First visit. 16 July 1972, between 1030-1100 hrs (W. Aust. Stan Time). Observers: D. and N. McFarland. Conditions: a completely sunny bright, crystal clear morning, with a fairly steady, chilly and strong E to

wind. A single *C. behri* male was flying vigorously over the hilltop, oriented to face into the strong wind, and "fighting" hard to maintain itself in this position, its flight fluctuating from 1-2 m to only a few centimetres above the ground. Wind gusts constantly kept carrying the moth W or SW, somewhat away from its chosen position over the hilltop; just as persistently, the moth kept returning to its former position. Occasional very strong gusts swept it downwind (30 m or more) but it always returned as quickly as the conditions permitted. Several times it hovered low, as if about to alight on the hilltop gravel, but was usually blown back off the western edge. Once it alighted on the ground for a few seconds, with its wings up and partially open. While we made these observations, the moth "investigated" us several times, approaching closely but never alighting on us. It was very alert, and quick to respond to any sudden movement. Repeatedly I tried to scare it off by lunging suddenly at it and chasing it with my net. Always it quickly returned to the hilltop after its initial avoidance response, which was to allow itself to be carried rapidly downwind, an effective escape mechanism employed by many insects in windy places. No other individuals of *C. behri* were seen on this date.

Second visit. On 28 July 1972 we returned to the hilltop at 1100 hrs, on a clear, sunny and warm (±22°C) morning, with only faint and sporadic breezes from the south west. Two *C. behri* males were observed chasing each other slowly around the hilltop, one of them frequently landing on one of the two *Acacia* bushes and sometimes on the *Casuarina*. At about 1140 hrs, one of them left and did not return. The other, a rather worn specimen, stayed on the hilltop, patrolling at intervals and resting on the bushes from time to time, usually with its wings up and semi-open, ready for instant flight. It was observed to be alert and "jumpy" when so resting. We chased and netted it several times, but upon each release it always returned after its initial short escape flight. At about 1155 hrs, the SW wind had become stronger and gusty. We left at 1210 hrs, by which time the wind had become steady but not cold. When we left, the second moth was at rest, but alert, on the *Casuarina* bush. Various small scarabs, flies and Hymenoptera were also on the hilltop that morning.

Third visit. On 1 Sep. 1974 I returned alone to the hilltop at 0845 hrs hoping to witness the earliest arrivals. It was brightly sunny and there was a strong and gusty NE wind (not cold). No moths were present. At 0905 hrs a large and fresh female flew upwind from the SW, with a slow and meandering flight, as if searching, at about 0.5 to 1 m above the hilltop. After cruising twice in this manner around the hilltop it flew (at 0906 hrs) to the north and did not return. At 0908 hrs, a small and fresh male arrived from the SW; it patrolled the hilltop several times and was then netted, marked and released. Upon release it flew off a short distance, but immediately returned and continued its fluttering over and around the hilltop, landing several times on the SW side of the dead *Casuarina*. Whenever it landed the wings were held up and partially open, in readiness for instant flight; it would leap into flight at the slightest disturbance. When I left at 0935 hrs it was still on the hilltop.

Fourth visit. On 13 Oct. 1974 we visited the hilltop at 0910 hrs; no moths were present. It was sunny and warm, with a strong and steady wind blowing

from the E, which gradually died down by 0950 hrs. The first arrival was a m male at 0929 hrs. It circled the hilltop once, in a leisurely fashion, wh included a brief investigation of me where I was sitting; it then left and did return. A larger male arrived at 0950 hrs and circled the dead *Casuarina* sev times. Then it was netted, flew off upon release, and did not return. No m arrived during the next 15 min.; we left at 1007 hrs.

LOCALITY 2. Drummond Cove, on the coast about 12 km N of Ger ton; on 2 March 1974 at 0800 hrs; weather warm, still and sunny. The site the summit of one of the stabilized white coastal sandhills (elev. about 1 above sea level). A *C. behri* male was noticed at 0800 hrs, flying persist around and over a large bush of *Acacia ligulata* Benth. (growing near a high po on the hill), occasionally investigating and sometimes pursuing other large ins that passed nearby. The bush was not in flower. I did not have much time spend this morning, and so was not able to observe the moth for more t about 5 minutes, but it was clearly exhibiting territorial behaviour on this s dune summit.

Defence behaviour

If handled after capture and removal from the net, males of *C. b* often exhibit an essentially static display (c.f. Blest, 1957). The fore wings hind wings are erected over the thorax and are held separate and motion The abdomen is curled or arched strongly downward towards the legs, w the claspers opened widely and the conspicuous orange, brush-like term tuft erected. The fore legs are bent in such a way that the conspicuous or tufts of the femur and tibia are exposed and displayed by thrusting th forward and outward. At the same time, the fore legs are kept faintly tremu but otherwise the moth remains motionless. In comparison with m bombycoids and some notodontioids, the display of *C. behri* is sustained only a short time, and, if not restrained, the moth is fairly quick to fly off. normal resting position of *C. behri* is tectiform, the fore wings totally cov the hind wings.

Except for the fore leg display and leg trembling, this defence behav in *C. behri* males is reminiscent of the sustained static displays exhibited *Hemileuca* spp. (Saturniidae) in North America, but was of shorter dura The distinctive sustained forward and outward thrust of bent fore l accompanied by minute trembling, can also be seen in the display of a roo handled male of *Pseudanapaea trigona* (Turner), a limacodid widely distri in Western Australia, South Australia and eastern Australia.

Discussion

It is possible that true hilltopping behaviour is exhibited by some o diurnal Australian moths, although the number of species involved is prob low, as elsewhere in the world. Worthy of scrutiny would be other dia agaristids, the diurnal uraniids, and perhaps even some castniids, although t appear to be no published records and I have no field observations to d that involve either of the last two families in hilltopping behaviour. That ample opportunity for studying hilltopping insects throughout Australia. I

the smallest hills, rocky ridges or sand dune summits in relatively flat or featureless localities, as well as the peaks and ridges of the major ranges, are often frequented.

Shields (1967) discusses this intriguing subject at length and provides an extensive bibliography. Common and Waterhouse (1972) briefly discuss hilltopping in Australian butterflies and skippers (pp. 44 - 45), and list 15 species observed on a hilltop near Sydney. However, true hilltopping by nocturnal Lepidoptera remains at present unknown in Australia and certainly warrants investigation.

Welling (1958) has described encounters with congregations of various moth species on the summits of hills, and on the Allegheny Plateau (Ohio, U.S.A.) at night. On the windless night of 14 June 1953 (early summer), carrying a lantern up Gildersleeve Mountain (150 m high), he saw no moths except at the very summit, where "hundreds of moths of many species were sitting everywhere, on tree stumps, on low plants, dead twigs, leaves, in short on anything available. As they were already there when I arrived at the summit, I presume the lantern could not have been the determining factor for their congregation in such a place".

Acknowledgements

I would like to thank Oakley Shields, I.F.B. Common and others for reviewing the manuscript and offering helpful criticisms; Shields also for bringing to my attention the paper by Welling (1958) and providing the above quotation from it.

References

Blest, A. D., 1957. The evolution of protective displays in the Saturnioidea and Sphingidae (Lepidoptera). *Behaviour* 11: 257-309.

Common, I. F. B., 1966. *Australian Moths*. Jacaranda Press, Brisbane. (adult male of *C. behri* illustrated on p. 121).

Common, I. F. B., and Waterhouse, D. F., 1972. *Butterflies of Australia*. Angus and Robertson, Sydney.

Shields, O., 1967. Hilltopping. *J. Res. Lepid.* 6(2): 69-178.

Welling, E. C., 1958. Some notes on the "excelsior" complex, regarding microtopology with Heterocera in Ohio. *Lepid. News.* 12: 131-132.

A NEW LOCALITY FOR *SIGNETA TYMBOPHORA* (MEYRICK & LOWER) (LEPIDOPTERA: HESPERIIDAE)

By G. Daniels
98 Harris Street, Fairfield, N.S.W., 2165.

Whilst travelling through northern New South Wales during December 1975, an adult male specimen of *Signeta tymbophora* was taken in the vicinity of Mt. Warning, west of Murwillumbah, feeding at *Lantana* blossom. The record of *S. tymbophora* in this area is noteworthy as the species has not previously been recorded in northern New South Wales, although it is known from southern Queensland and central to southern New South Wales.